SPECTRAL LINE SHAPES IN THE $2\nu_3$ Q BRANCH OF $^{12}CH_4$

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We will present the first experimental measurements of spectral line shapes (self- and air-broadened half width, pressure shift, and line mixing (via off-diagonal relaxation matrix element) coefficients and their temperature dependences, where appropriate, for transitions in the $2\nu_3$ Q branch manifolds of $^{12}CH_4$ in the 1.6 μm region. Employing a multispectrum nonlinear least squares technique[a], we simultaneously fitted 23 high-resolution spectra of $^{12}CH_4$ and mixtures of $^{12}CH_4$ in air, recorded at different pressure-temperature combinations between 130 and 296 K. These data were recorded using the Bruker IFS 125 HR Fourier transform spectrometer at the Jet Propulsion Laboratory together with two coolable sample cells[b,c]. By applying a set of constraints to the parameters of severely blended transitions, a self-consistent set of broadening, shift and line mixing parameters for CH_4-CH_4 and CH_4-air collisions were retrieved. A quadratic speed dependence parameter common for all transitions in each Q(J) manifold was determined. In addition to line shape parameters, line positions and line intensities were also measured for over 100 transitions in the whole Q branch region (5996.5 - 6007.7 cm^{-1}). Comparisons of present results with values in HITRAN2012 will be provided[d]

[a] D.C. Benner, C.P. Rinsland, V. Malathy Devi, M.A. H. Smith, and D. Atkins. JQSRT 53 (1995) 705-721

[b] K. Sung, A.W. Mantz, M.A.H. Smith, L.R. Brown, T.J. Crawford, V.M. Devi, D.C. Benner. J.Mol. Spectrosc. 162 (2010)124-134.

[c] A.W. Mantz, K. Sung, T.J. Crawford, L.R. Brown, M.A.H. Smith, V.M. Devi, D.C. Benner, J. Mol. Spectrosc. 304 (2014) 12-24.

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